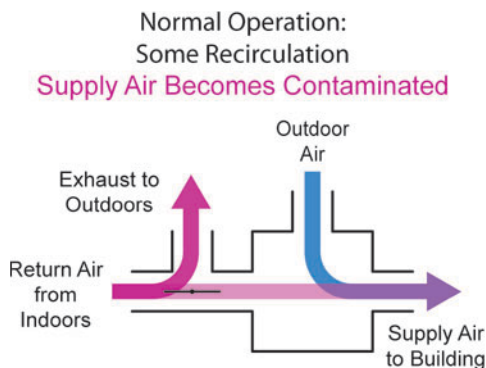


# First Responders to an Indoor Chemical Release

## Ventilation System ON

1. If supply air becomes contaminated, contaminant will spread rapidly through the entire ventilation zone: every supply register in that zone becomes a source. This can happen:
  - (a) if contaminated outdoor air enters the intake.
  - (b) if contaminant-bearing air from inside the building is recirculated.
2. Most commercial buildings recirculate indoor air, if outdoor air is hot or cold. In this case, supply air (into the building) will eventually become contaminated, so the pollutant will spread everywhere.



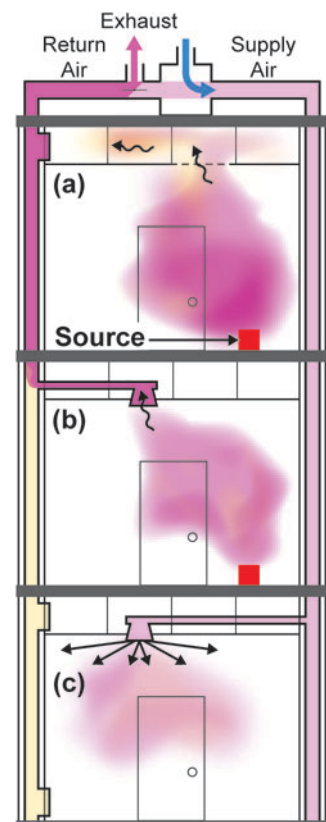
- (a) Most ventilation systems supply a mix of outside air and recirculated (return) air.
- (b) In extreme hot and cold weather, the mix shifts to higher recirculation.
- (c) In mild temperatures (55-70°F), some buildings take in as much outdoor air as possible.



3. The ventilation system causes large air flows that move contamination through the building.

A ventilation zone may cover a large or small area, and may mix air between floors.

- (a) A ceiling air return plenum may serve a single room or a large zone; contaminated air can be pulled along in the plenum and may quickly enter the supply air (1-10 min.)
- (b) If a contaminated room has a "ducted return", contaminated air will probably enter the supply air very rapidly (20 sec - 3 min).
- (c) If supply air is contaminated, contamination will spread throughout the whole ventilation zone rapidly (seconds or minutes): Every supply register in the zone becomes a source.

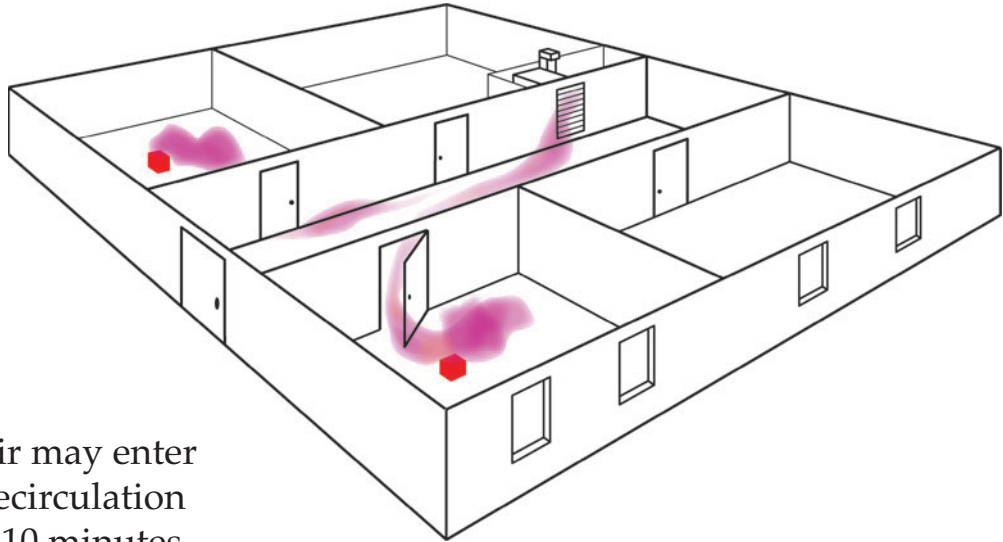


## First Responders to an Indoor Chemical Release

### Ventilation System ON

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4. A return air grille in a hallway can draw contaminated air into and along the hall, even if doors are closed.



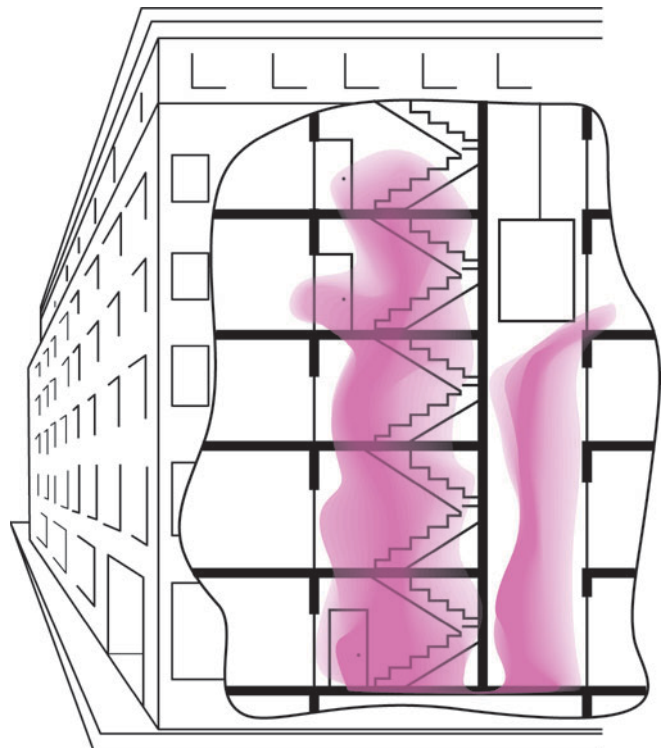
Contaminated air may enter supply air via recirculation (see item 1) in 1-10 minutes.

5. A stairwell, elevator shaft, or utility chase can provide a pathway for flow between floors. The ventilation system can force airborne contaminants to flow either up or down.

A moving elevator creates a piston effect that can force contamination to flow up or down.

Flows can be significant even if elevator doors and stairwell doors are closed.

Unlike smoke, contaminants can be either heavier or lighter than air, and so can sink or rise even in still air.



# First Responders to an Indoor Chemical Release

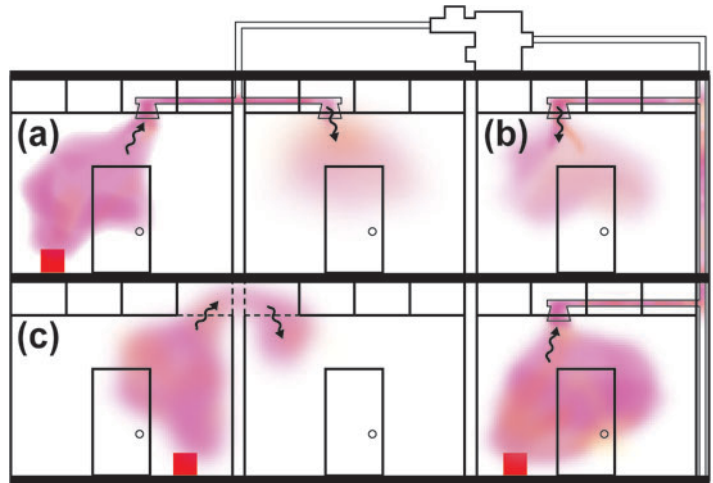
## Ventilation System OFF

1. Effects that can be ignored when the ventilation system is on, become dominant when it's off. Examples are wind leaking into the building, drafts, and buoyancy (warm air rises, cool air sinks).

2. Air flows are generally slower than when the ventilation system is on. Ventilation ducts provide pathways for contamination to flow between rooms and floors, even with the ventilation system turned off.

Temperature and pressure differences can drive flow upward or downward between floors. Contaminant can flow from room to room, for example:

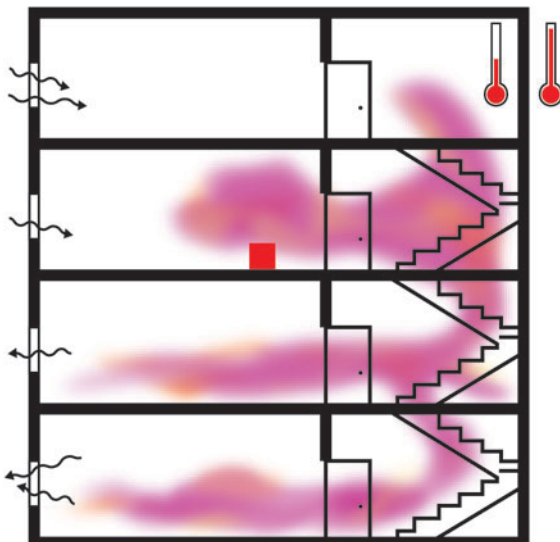
- (a) horizontally through ducts
- (b) vertically through ducts or other openings
- (c) through the ceiling plenum



3. Flows depend strongly on wind and on the indoor-outdoor temperature difference, especially when windows are open.

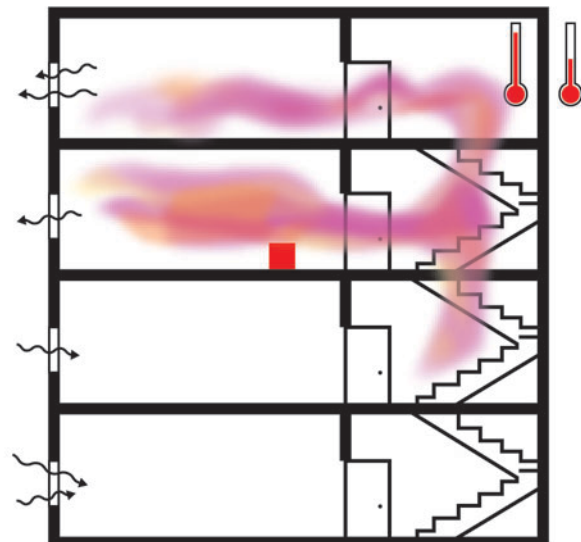
### Outdoors Warmer:

Indoor air, which carries the contamination, tends to descend as it leaks from the building. Outside air enters upper floors. Some contamination may still move upwards due to local flows or drafts.



### Outdoors Cooler:

Indoor air, which carries the contamination, tends to rise as it leaks from the building. Outside air enters lower floors. Some contamination may still move downwards due to local flows or drafts.



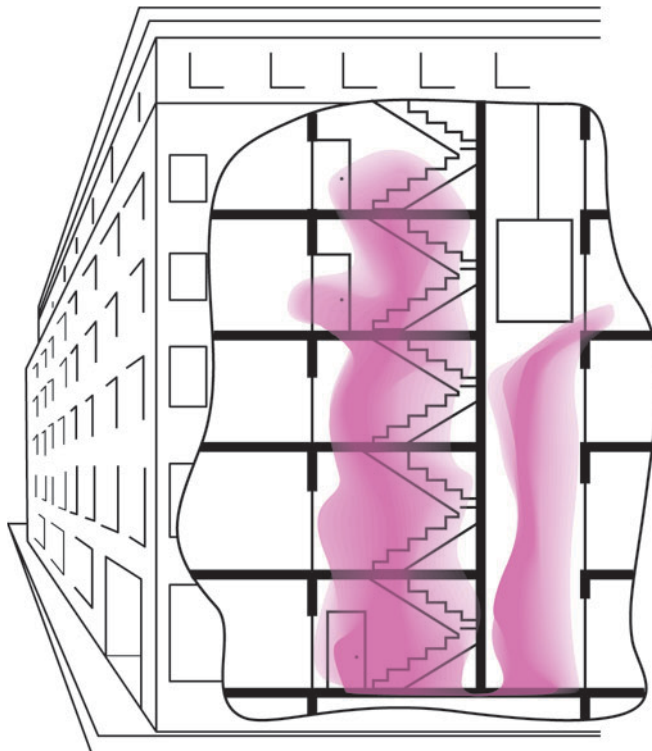
# First Responders to an Indoor Chemical Release

## Ventilation System OFF

4. Fast or strong vertical flows can occur through elevator shafts, stairwells, utility chases, and other connections between floors.

Horizontal flows are usually weaker than vertical flows, except when there are strong winds or other causes of horizontal pressure differences.

Unlike smoke, contaminants can be either heavier or lighter than air, so they can sink or rise even in still air.



For more information see

**<http://SecureBuildings.lbl.gov>**

or contact

Dr. Phillip Price  
Lawrence Berkeley National Lab  
1 Cyclotron Road  
Mailstop 90-3058  
Berkeley, CA 94720

[PNPrice@lbl.gov](mailto:PNPrice@lbl.gov)

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